

impurities in amounts of the order of tens of weight ppm. Accordingly, claims 5, 7-12, 14, 15, 17-19, 21, and 22 are pending and at issue.

Claims 5-8 and 15-22 have been rejected under 35 U.S.C. §103(a) as obvious over Japanese Patent Publication Nos. 62047443 (JP '443) and 61133351 (JP '351). Claims 5-22 have been rejected under 35 U.S.C. §103(a) as obvious over Japanese Patent Publication Nos. 10195562 (JP '562) or 09078162 (JP' 162).

The Examiner asserts that the impurities in the copper alloys recited in JP '443, JP '351, JP '562, and JP '162 would inherently possess the impurities recited in pending claims.

Each of the cited prior art references describe *refined* copper microalloys. Refining processes typically remove impurities. Therefore, unless indicated otherwise, the copper microalloys described in JP '443, JP '351, JP '562, and JP '162 do not necessarily contain impurities other than those recited. For example, the refined copper microalloys disclosed in two references attached as Exhibits A and B do not contain zinc (Zn) or tin (Sn).


None of these references disclose or suggest a copper microalloy having all of the impurities in the amounts recited in the pending claims.

For the foregoing reasons, the cited prior art fails to render obvious the claimed invention. Accordingly, applicants respectfully request withdrawal of this rejection.

In view of the above amendments and remarks, it is respectfully requested that the application be reconsidered and that all pending claims be allowed and the case passed to issue.

If there are any other issues remaining which the Examiner believes could be resolved through either a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below.

Respectfully submitted

  
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Marked-Up Claims  
Accompanying September 23, 2002 Amendment  
For U.S. Serial No. 09/499,207  
(Docket No. 2136/OG684)

5. (Twice Amended) A method for the manufacture of a copper microalloy comprising:

(a) mixing a copper alloy containing S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag or Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm; and

(b) continuous casting the microalloy.

9. (Twice Amended) A method for the manufacture of a copper microalloy containing lead, comprising:

(a) mixing a copper alloy containing (1) S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag, or Te impurities in amounts of the order of tens of weight ppm and (2) less than 80 weight ppm of the impurities Zn, Ag, Cd, Sb, Ni, Fe, Bi, Sn and S with lead to yield a microalloy having at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm;

(b) continuous casting the microalloy from step (a); and

(c) heating the microalloy from step (b) at 550-650° C for 5-600 seconds to decrease its half-softening temperature, annealing temperature, and recrystallization temperature to below 200° C.

15. (Amended) A method for the manufacture of a copper microalloy

comprising:

(a) mixing a copper alloy consisting essentially of copper and one or more of S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag and Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm; and

(b) continuous casting the microalloy.

19. (Amended) A method for the manufacture of a copper microalloy

comprising:

(a) mixing a copper alloy consisting of copper and one or more of S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag and Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm; and

(b) continuous casting the microalloy.

Pending Claims  
(After September 23, 2002 Amendment)  
For U.S. Serial No. 09/499,207  
(Docket No. 2136/0G684)

5. (Twice Amended) A method for the manufacture of a copper microalloy comprising:

(a) mixing a copper alloy containing S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag or Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm; and

(b) continuous casting the microalloy.

7. The method of claim 5, wherein the microalloy has a lead content of more than 300 weight ppm.

8. The method of claim 5, wherein the microalloy has a lead content of more than 350 weight ppm.

9. (Twice Amended) A method for the manufacture of a copper microalloy containing lead, comprising:

(a) mixing a copper alloy containing (1) S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag, or Te impurities in amounts of the order of tens of weight ppm and (2) less than

80 weight ppm of the impurities Zn, Ag, Cd, Sb, Ni, Fe, Bi, Sn and S with lead to yield a microalloy having at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm;

(b) continuous casting the microalloy from step (a); and

(c) heating the microalloy from step (b) at 550-650° C for 5-600

seconds to decrease its half-softening temperature, annealing temperature, and recrystallization temperature to below 200° C.

10. The method of claim 9, wherein the microalloy has a lead content of more than 300 weight ppm.

11. The method of claim 9, wherein the microalloy has a lead content of more than 350 weight ppm.

12. The method of claim 9, wherein the hydrogen content of the microalloy is 0.5-0.7 weight ppm after casting.

14. The method of claim 9, whereby the electrical conductivity of the microalloy is increased to values greater than 101% IACS.

15. (Amended) A method for the manufacture of a copper microalloy comprising:

(a) mixing a copper alloy consisting essentially of copper and one or

more of S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag and Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm; and

(b) continuous casting the microalloy.

17. The method of claim 15, wherein the microalloy has a lead content of more than 300 weight ppm.

18. The method of claim 15, wherein the microalloy has a lead content of more than 350 weight ppm.

19. (Amended) A method for the manufacture of a copper microalloy comprising:

(a) mixing a copper alloy consisting of copper and one or more of S, Se, As, Sb, Bi, Sn, Zn, Ni, Fe, Ag and Te impurities in amounts of the order of tens of weight ppm, with lead to yield a microalloy having a final concentration of at least 200 weight ppm of lead, wherein the copper alloy contains Zn, Fe, Ni, Sn, and Ag impurities in amounts of the order of tens of weight ppm; and

(b) continuous casting the microalloy.

21. The method of claim 19, wherein the microalloy has a lead content of more than 300 weight ppm.

22. The method of claim 19, wherein the microalloy has a lead content of more than 350 weight ppm.



# Extractive Metallurgy of Copper

by

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TABLE 15.1 INDUSTRIAL RANGE OF ANODE AND CATHODE COMPOSITIONS IN MODERN REFINERIES

Element	Anodes (range of %)	Cathodes (range of %)
Cu	99.4-99.8	99.99-100
O	0.1-0.5	(not included in analysis)
N	0-0.5	trace-0.0010
Pb	0-0.1	trace-0.0005
As	0-0.3	trace-0.0002
Sb	0-0.3	trace-0.0002
Se	0-0.02	trace-0.0002
Fe	0.002-0.03	0.0002-0.0020
Te	0-0.001	trace-0.0001
S	0.001-0.003	0.0004-0.0018
Bi	0-0.01	trace-0.0001
Ag	trace-0.1	0.0005-0.001
Au	0-0.005	0-0.00001

Eichrodt and Schloen (1954)

immersed in a cell containing an acidified copper sulphate solution, causes the following reactions and processes to take place:

- (a) Copper is electrochemically dissolved from the anode into the solution, i.e.



producing copper cations plus electrons.

- (b) The electrons produced by reaction (15.1) are conducted towards the cathode through the external circuit and power supply.  
 (c) The  $\text{Cu}^{2+}$  cations in the solution migrate by diffusion and convection to the negative electrode (cathode).  
 (d) The electrons and the  $\text{Cu}^{2+}$  ions recombine at the cathode surface to produce copper metal which plates on the cathode, i.e.



The net effects are the electrochemical dissolution of copper from the anode, the migration of electrons and copper ions towards the cathode,

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## REFINADO ELECTROLITICO

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a fin de obtener ánodos con proporción uniforme de plata y con una cantidad tolerable de impurezas.

Los cátodos de cobre refinado, de superficie lisa, contienen más del 99.98 % de cobre, en tanto que los cátodos de superficie rugosa solo contienen el 99.95 %. Su ar-

TABLA 28 - ANALISIS DE COBRE ELISTER, DE LOS ANODOS Y DE LOS CATODOS

Analisis	Elister	Anodo	Catodo
Cu - Cobre	99.0140 %	99.4220 %	99.9800 %
O - Oxígeno	0.6910 %	0.1540 %	0.0000 %
S - Azufre	0.0185 %	0.0028 %	0.0010 %
As - Arsénico	0.0464 %	0.0435 %	0.0010 %
Sb - Antimonio	0.0350 %	0.0317 %	nulo
Pb - Plomo	0.0039 %	0.0042 %	0.0003 %
Se - Selenio	0.0184 %	0.0156 %	0.0012 %
Te - Teluro	0.0122 %	0.0122 %	0.0016 %
Ni - Níquel	0.0140 %	0.0146 %	0.0016 %
Ag - Plata	1986 g/t	1950 g/t	94 g/t
Au - Oro	9.25 g/t	9.25 g/t	

TABLA 29 - CUADERNO DE LA MARCHE DE UN TANQUE

Peso total de los ánodos	5379.7 kg
Peso del residuo de los ánodos	761.4 kg
Peso de los ánodos	5618.7 kg
Duración total de la electrolisis	31 d 17 h 55 min
Peso del cobre depositado	5389.1 kg
Intensidad media durante el proceso	6700 A
Rendimiento de corriente	91.3 %
Barro	2636.5 kg
Cantidad	
Barro en unidad de peso por tonelada de cobre refinado	418 kg
Analisis del barro	
Cobre	19.80 %
Plata	51.008 % 515 kg/t
Oro	0.2171 % 2170 g/t
Arsénico	3.90 %
Antimonio	8.04 %
Plomo	1.06 %
Selenio	4.37 %
Teluro	2.99 %
Níquel	0.05 %

senico ha bajado del 0.046 % a menos del 0.001 %, y el antimonio, de más de 0.030 a menos de 0.001 %. El selenio y el teluro, que figuraban en el ánodo en proporción de más del 0.01 % han disminuido hasta el punto de que el cátodo contiene me-  
nos de 0.0003 %. En el cátodo, una vez terminado, la mayor impureza la constituyen  
los gases absorbidos, que representan más de la mitad del 0.02 % que no es cobre.

El análisis ponderal del cobre anódico y del barro, para un tanque cualquiera.

México - D.F.